E N E R G Y S E C U R I T Y I S S U E S

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TABLE OF CONTENTS

		Page
1.	Introduction	1
2.	Focus of the Saskatchewan Paper Security of Oil Supply	2
3.	Policy Responses and Principles to Promote Security of Oil Supply	3
4.	Saskatchewan's Oil Supply	4
5.	Constraints to Oil Supply Enrichment	5
6.	Enhanced Oil Recovery	6
7.	Heavy Oil Upgrading	8
8.	Alternative Transportation Fuels	9
9.	Conclusion	9

Appendix A: Coal, Uranium and Natural Gas in Saskatchewan

Appendix B: Saskatchewan's Oil Supply

Appendix C: Alternative Fuels

SASKATCHEWAN PAPER ON ENERGY SECURITY ISSUES

1. Introduction

Light crude prices fell from the $30/bbl U.S. range in November 1985 to a low of about $10/bbl U.S. in March 1986. In Saskatchewan, about one third of our crude oil production and half of the wells were threatened with the prospect of being shut-in. Combined with impacts elsewhere in Western Canada, it seemed possible that Canada would rapidly lose the ability to supply its crude oil needs and along with that much of the expertise developed by the industry in past decades.

At the meeting of the Council of Provincial Energy Ministers held in Banff in September, 1986, the ministers unanimously agreed that the situation facing the industry was a national problem, and that it required a national solution. Ministers acknowledged that the world oil price outlook remained very uncertain and the unstable situation required further measures to ensure the survival of a Canadian industry and the development of new energy supplies.

At the meeting, the provinces of Alberta, Quebec and Saskatchewan struck a task force to review Canada's future light oil supply/demand balance, the future availability and deliverability of domestic crude oil on a regional basis, and opportunities to reduce our future light oil dependence. The result was a joint paper entitled Security of Supply, An Opportunity for Canada. We concluded that:

- conventional crude will continue to make a contribution to security but it can no longer be the sole source. Security could be enhanced by reducing demand through conservation or fuel substitution, and by increasing supply through development of conventional crude in the western sedimentary basin and offshore, and development and upgrading of tar sands and heavy oil;

- deregulated market prices are critical to ensuring the most efficient decisions regarding short-term energy supply and demand, but long-term capital projects must be reviewed in terms of broader Canadian interests; and

- declining conventional oil production in western Canada was shown to have implications for the viability of the Sarnia-Montreal pipeline.

The National Energy Board report of October, 1986, Canadian Energy Supply and Demand, 1985-2005, underlined the Banff conclusions. Under low oil prices, light crude oil imports into Canada will increase to 64% of light crude oil demand by the year 2005. Imports into Ontario could reach 70,000 cubic metres per day in 2005. At the same time, Canada will continue to have an exportable surplus of heavy crude oil. Even under the high price scenario, 40% of light crude oil demand will be met with imports.

At a meeting of federal, provincial and territorial energy ministers in January, 1987, the issue of energy security was reviewed and discussed at length. The ministers unanimously agreed that the downturn in Canada's oil and gas industry was an issue of national, not just regional, importance. The ministers also reaffirmed their belief that adherence to market mechanisms is important to ensure that the most efficient decisions are made regarding supply and demand. However, they noted that large scale energy projects often involve exceptional levels of risk for private investors, and may have broader benefits for national and regional economic development and energy security. The ministers discussed Canada's energy trade relations with the United States and agreed to cooperate in constructive ways to remove existing trade barriers and avoid new ones.

To continue progress related to the issue of energy security achieved at the meeting, the ministers agreed to form a working group to consider additional papers on energy security which the various governments wished to prepare. This paper represents Saskatchewan's response to the call for papers at the January meeting.

2. Focus of the Saskatchewan Paper - Security of Oil Supply

The federal government's paper, Energy Security in Canada, A Discussion Paper, released in June provides a comprehensive assessment of the energy security issue from the perspective of oil price shocks and supply disruptions. Saskatchewan supports the emphasis placed on international trade and emergency sharing obligations among industrialized countries, and on the use of market mechanisms to ensure efficient allocations of resources. The paper also addresses the problem of guarding eastern Canada against short-term supply disruptions in an efficient and cost effective manner.

Saskatchewan's paper on energy security focuses on issues concerning the future availability of oil supply from the western sedimentary basin. In addition to reserves of light oil, Saskatchewan has a huge heavy oil base representing half of Canada's current heavy oil productive capacity. The province's future potential to diversify and extend domestic oil supplies is largely dependent upon our ability to enhance recoveries from existing light and heavy pools and to upgrade heavy oil into a more usable form.

In addition to oil, Saskatchewan has significant reserves of other energy commodities, namely uranium, coal and natural gas. We agree with the emphasis placed on oil by the provincial ministers in January and with the observation made by the federal government in their June report that the issue of energy security today is largely one dealing with oil, given Canadian dependence on this fuel source, particularly in the transportation and agricultural sectors. For this reason, a description of Saskatchewan non-oil energy reserves and their potential contribution to overall Canadian energy security is provided in Appendix A.

3. Policy Responses and Principles To Promote Security of Oil Supply

Before turning to a more comprehensive discussion of oil supply enhancement, Saskatchewan would like to put forward a set of policy principles which should guide any consideration of energy security issues. Many of these principles were put in place with the signing of the Western Accord in 1985 and should be the cornerstone of any future energy policy development.

First of all, development of future oil supplies must start with a healthy and stable oil and gas industry. Infrastructure, technology and personal expertise have been developed over many years -- it is in the interest of governments and the industry to retain some minimum level of activity to support this base during a severe downturn in prices. Governments recognized this need for a stable infrastructure and reacted quickly and responsibly to maintain a viable industry following the recent price fall.

Saskatchewan introduced a temporary program to reduce royalty rates and sustain employment in the supply and services sector. At the end of 1986 Saskatchewan amended its drilling incentives and introduced a price sensitive royalty regime which provides industry with a known long-term fiscal structure under which to operate while still allowing flexibility as prices rise and fall.

The federal government also responded with the early removal of the petroleum and gas revenue tax (PGRT). The recently announced Canadian Exploration and Development Incentive Program (CEDIP) will also provide a necessary infusion of working capital for the "small producer" segment of the industry.

As a result of some price recovery and government policy initiatives, the industry has stabilized. Land sale interest and drilling activity have increased. In the Saskatchewan June land sale, bonus bid revenues exceeded the sum of the previous four sales. Drilling activity has reached levels of 100 wells per month compared to 20 wells per month during late 1986. Production in 1987 is expected to exceed 1986 levels. Saskatchewan is particularly optimistic about new discoveries in deep formations in the southeastern part of the province. This turnaround illustrates how responsible actions by governments can contribute to the maintenance of a relatively healthy environment for industry.

Secondly, competitive forces must continue to determine price. We cannot afford the economic distortions which recently accompanied "made in Canada" oil prices, when price incentives to reduce consumption were dampened and refiners were effectively discouraged from investing in upgrading capacity. Increasing demand for light oil will increase the potential for upgrading vast western heavy oil reserves, and will induce some refiners to improve their capacity to utilize heavier grades of oil. World oil prices are volatile but they do reflect the true opportunity cost to Canadian sellers and buyers.

Thirdly, there must be unrestricted trade with other provinces and countries. Saskatchewan currently exports two-thirds of its total crude oil production to the United States because of our heavier crude slate. Saskatchewan producers have worked hard to develop U.S. markets and to rebuild a reputation as a reliable supplier to these refiners which have made the necessary investments to utilize our heavier crude oils. From transportation systems to international emergency treaties, Canada is part of the highly interdependent world oil system.

Both supply and demand options for enhancing oil security should be pursued according to their economic merit. Emergency responses should be designed according to the anticipated costs and likelihood of the supply disruption they are there to counteract. If the costs of increased dependence on foreign oil justify public involvement in developing incremental domestic supplies, then the source of incremental supply should be chosen on economic grounds.

We concur with the federal government's announced approach to federal participation in major projects. This approach is that when there is significant private sector equity in a project which is deemed to be of national importance to Canada's energy economy, the government will seek an acceptable return on any investment it makes and a fair and equitable sharing of risks and benefits between the public and private sectors.

This definition would seem to allow some federal consideration of the divergence between private and social costs or benefits, if the government takes a broad perspective on what constitutes a return to the government. A full cost/benefit analysis may indicate that governments should participate in one way or another to allow certain projects to proceed.

Essentially, fundamental economic merit should be the basis for determining those projects which should proceed.

Finally, if Canadians decide to incur certain costs to increase our oil supply security, then we as a country should bear these costs. The responsibility for paying for oil security does not belong with oil producers nor with oil producing provinces alone.

In summary, the guiding policy principles are that future development must start with a healthy industry, competitive forces must determine price, there must be unrestricted trade between provinces and countries, and fundamental economic merit should be the basis for the development of future projects.

4. Saskatchewan's Oil Supply

Saskatchewan can contribute to enhanced oil supply by optimizing conventional production within a competitive market pricing environment and a flexible fiscal regime, by encouraging enhanced oil recovery to unlock the vast reserves of heavy oil and remaining light oil, and by supporting upgrading where economic merit would indicate.

At present, Saskatchewan has a productive capacity of 35,000 cubic metres of crude oil per day or approximately 13% of Canada's total productive capacity. Our production of crude oil is currently 65% heavy oil (as defined by the National Energy Board to include what we call medium oil) and 35% light oil. These production mix figures have remained relatively constant over the last ten years and will not likely change significantly in the near future because of low oil prices.

A recent forecast of productive capacity in Saskatchewan shows a gradual decrease in capacity over the next ten years, from 35,000 to 31,000 cubic metres of crude oil per day. As this decrease is in step with the Canada-wide situation, our per cent share of Canada's productive capacity should remain relatively constant.

About half of the nation's current heavy oil production capacity is in Saskatchewan. This heavy oil productive capacity, along with Saskatchewan's huge heavy oil reserve base, are major factors to consider when determining the province's possible contribution to security of supply. Further details on Saskatchewan's crude oil supply potential are given in Appendix B. A summary of the ultimate recoverable reserve potential is shown in the table below. Approximately 35% of our estimated ultimate crude oil supply potential has been produced to date.

Ultimate Recoverable Reserve Potential
(Millions of Cubic Metres)

Lloydminster/Kindersley Heavy	360
Swift Current/Weyburn/Estevan Heavy	320
Kindersley/Weyburn/Estevan Light	270
	950

5. Constraints to Oil Supply Enrichment

In the October, 1986 National Energy Board (NEB) report titled Canadian Energy, Supply & Demand 1985 - 2005 the NEB concluded that "conventional oil and gas supply sources will not be adequate to meet Canada's future requirements". Most of the shortfall will be in the production of light oil suitable for use as a feedstock for eastern refineries. The current domestic demand for light and medium crudes for refining is about 200,000 cubic metres per day. Canada is currently a net exporter of light and medium crudes but by 1995 the domestic production of light and medium crudes for refining will only supply about 65% of the demand.

Several constraints to increasing or maintaining the supply of oil exist and perhaps the most important of these constraints is the current price of oil. At today's prices, the incentive for companies to make major expenditures on drilling or EOR in heavy oil areas has been significantly reduced. We estimate that over the next ten years only 10% of Saskatchewan's undeveloped potential for Lloydminster type heavy oil will be developed. With this rate of heavy oil development, the net recoverable reserves will decline and thus limit our ability to contribute to Canadian energy security.

Closely related to the economics of heavy oil production is the technology available for producing heavy oil. As the existing technologies are improved and advanced technologies are developed, the economics for heavy oil production and EOR will improve. These technologies will not likely be developed, however, without the assistance of both the federal and provincial governments.

Under our new fiscal regime for crude oil, Saskatchewan has ensured that marginal production is kept on stream. Extended royalty holidays for exploratory wells and deep exploratory wells have already resulted in promising new finds. By making our royalty system price and production sensitive we hope to achieve long-term stability while keeping needed flexibility.

Saskatchewan light oil production will continue to decline, however, so the most important contribution that Saskatchewan could make to increase the light oil supply would be via the conversion of our heavy oil to light oil through upgrading. As indicated above, heavy oil represents a significant portion of Saskatchewan's production today and the heavy oil potential in Saskatchewan is just beginning to be exploited.

A possible constraint on the utilization of Saskatchewan's heavy oil potential is the forecasted condensate (pentanes plus) supply shortages. By as early as 1990 there may not be enough diluent available to pipeline all the heavy crude oil from the Lloydminster/Kindersley areas. There are other alternatives for diluent sources such as refined napthas or light crude oil but the cost of these products may be prohibitive.

6. Enhanced Oil Recovery

The government of Saskatchewan has taken significant steps to improve our oil resource base, from granting five year royalty holidays for deep exploratory wells to promoting research into enhanced oil recovery. The jointly funded Canada-Saskatchewan Heavy Oil/Fossil Fuels Research Program has emphasized research into heavy oil and enhanced oil recovery (EOR). EOR opens the possibility of bringing large and otherwise inaccessible oil reserves into production, with the particular benefits of very low exploration costs and relatively low drilling costs. Saskatchewan alone has potential EOR reserves of 667 million cubic metres, over five times our level of remaining established reserves.

Research into EOR provides an important public good -- the development and dissemination of technology which can improve recovery rates. EOR includes diverse, but frequently unproved, recovery processes designed to produce the residual oil bypassed by current primary and secondary processes. EOR can be divided into two categories:

- implemented - those technologies such as steamflooding presently being applied in field tests, and

- advanced - those technologies such as horizontal wells presently at the conceptual or experimental stage.

In either category, the unpredictable technical performance of EOR techniques is the most significant constraint to EOR development. The unpredictable performance is a result of insufficient understanding of this residual oil resource, the reservoir and the effects of the techniques applied to mobilize and displace the oil.

The successful development of these technologies will provide the means to tap the enormous reserves of residual oil remaining within existing pools. The potential for adding reserves by enhancing the recovery from existing pools far exceeds the reserves addition potential associated with new oil discoveries. If governments are going to invest some money in obtaining energy security, technology is likely to be one of the most cost-effective mechanisms. Getting the required technology on the shelf can speed up development of new projects when prices increase. Co-ordinated research efforts allow Canadians to solve problems once rather than having each company solve the same problems individually. Governments have a role to play in ensuring research efforts are directed in the most cost-effective manner.

Current estimates of primary (conventional pumping) and secondary (waterflooding) production techniques indicate that less than 25% of the original-oil-in-place in Saskatchewan's light and medium oil reservoirs will be recovered. From proven reserves of light and medium oil-in-place, over one billion cubic meters will remain in-place after primary and secondary recovery methods have been exhausted. Enhanced oil recovery offers the opportunity to substantially increase recovery factors and to maintain production from many of Saskatchewan's reservoirs nearing depletion. Indeed, it is essential to encourage the development of EOR in these light and medium reservoirs now--once depletion of primary and secondary reserves has been reached, the likelihood of embarking on EOR is markedly reduced or even eliminated.

The unique characteristics of Saskatchewan's heavy oil reservoirs present many technical constraints to heavy oil development. Because of these constraints, primary and secondary production will recover only 5-10% of the original oil-in-place. Further, many of Saskatchewan's heavy oil reservoirs are not even producible by primary or secondary means. From proven resources of 2.8 billion cubic metres of heavy oil-in-place, over 2.5 billion cubic metres will remain in-place after primary and secondary production. EOR offers the opportunity to substantially increase recovery factors and may be the only means of producing many of Saskatchewan's heavy oil reservoirs.

Saskatchewan has a relatively attractive fiscal regime for EOR which recognizes the costs and risks associated with EOR development. Pre-payout crown royalties are the lesser of 5% of gross revenues or 10% of net operating revenue, with a minimum royalty of 1% of gross revenue to apply. Post-payout royalties are 30% of operating income, with a minimum royalty of 5% of gross revenue.

Under the recent federal tax reform proposal, the earned depletion allowance will be phased out for EOR projects. This valuable incentive has promoted the early stages of EOR research and development and helped build the foundation for further development, but significant technical risks remain. Earned depletion for EOR projects is a major incentive for continued progress and its removal will have a serious negative impact. In this regard, the commitment in the tax reform White Paper to consider what new forms of assistance might be required is particularly important.

The unpredictable technical performance of these EOR techniques, the resulting financial risk and the current state of low oil prices limits the ability of industry to carry out on its own the necessary research and development to develop these EOR technologies. Because a substantial portion of the benefits will accrue to the public sector, it is appropriate that costs of undertaking the necessary development of EOR technologies should be a shared responsibility of the provincial and federal governments and the private sector.

7. Heavy Oil Upgrading

Upgrading refers to the conversion of heavy crude oils into lighter crude oils. Crude oil refineries in Eastern Canada are highly dependent upon light oil for feedstock. Because of the distortive effects of regulated prices in the past, Canadian refiners, unlike their counterparts in the U.S., did not have the economic incentive to modify their facilities to accommodate the declining quality of crude oil supplies.

Upgrading heavy crude oil in Western Canada has several advantages from a transportation perspective. The upgraded crude streams are easy to transport in pipelines, whereas heavier crude streams must be mixed with a light diluent to facilitate pipeline movement. The light stream results in a more desirable refined product mix. Upgrading increases domestic value added, and, most importantly, will lead to increased exploitation of our known heavy oil reserves. Upgrading is a key element in any self-sufficiency or continuity of supply program.

Construction is underway on the Newgrade Upgrader in Regina, which will have a capacity of 8,000 cubic metres (50,000 barrels) per day. The feedstock is medium and heavy Saskatchewan crude.

Discussions between the federal, Alberta and Saskatchewan governments are continuing with respect to the Husky Bi-Provincial Upgrader project. The output from the proposed project is 7,300 cubic metres (46,000 barrels) per day of light synthetic crude and 1,300 cubic metres (8,000 barrels) per day of asphalt. The project would give a major impetus to Saskatchewan's heavy oil producing areas by providing a stable market to justify research and development and other large upfront costs.

8. Alternative Transportation Fuels

In the future, it is quite probable that Canada will depend on a number of unconventional feedstocks to supply its demand for transportation fuels. Besides developing its oil supply capacity through enhanced recovery of residual conventional oils and heavy oils, Saskatchewan has significant potential to supply future demand through the production of alternative transportation fuels. In particular, ethanol is gaining importance as an octane enhancer with desirable environmental qualities. This potential is outlined in Appendix C.

9. Conclusion

Energy security problems should be solved in the context of market prices, free trade and rational economic decision-making.

Saskatchewan's large known reserves of heavy oil, if upgraded, could become a major Canadian source of light crude oil.

Continued government efforts are needed to support research and development aimed at improving recovery technologies.

Policy Analysis
August 4, 1987
Policy 1429

APPENDIX A

Coal, Uranium and Natural Gas in Saskatchewan

Coal

According to the National Energy Board report, Canadian Energy Supply and Demand, 1985-2005, Saskatchewan has 27% of Canadian recoverable reserves of coal by volume and 18% by energy content. While the lignite coal found in Saskatchewan has a low sulphur content, high moisture levels and low energy content tend to limit the competitiveness of this coal in markets away from Saskatchewan. Currently the majority of Saskatchewan lignite is burned in mine-mouth thermal generating stations, but some is delivered as far away as northern Ontario. Governments have a role to play in supporting the development of technology required to reduce the cost of transportation. Indeed, the Federal government and the Ontario, Saskatchewan, Alberta and British Columbia governments have established a Task Force to review potential methods for improving the competitiveness of Western Canadian coal in Ontario, to review existing regulations and fiscal aspects of transportation and to initiate product oriented research and development programs related to coal technologies.

Uranium

Saskatchewan is currently the western world's leading uranium producing region with a productive capacity of 20 million pounds of U_3O_8 annually or one fifth of total world capacity. The Saskatchewan deposits are high grade by world standards and reasonably assured reserves are estimated to be just under one billion pounds of U_3O_8. In 1986 Ontario and Saskatchewan produced 30 million pounds of U_3O_8, 41% and 59% respectively. Approximately 15% of production was sold for use in Canadian nuclear generating plants which produce 12% of Canadian electricity.

The annual assessment of the uranium industry by Energy, Mines and Resources in September, 1986 reaffirmed that Canada's domestic needs for uranium are assured. Canada remains the centre of worldwide exploration activity, with Saskatchewan accounting for 75% of the Canadian exploration total. Several recently discovered deposits could be developed if markets become available.

Natural Gas

Significant progress has been made over the past five years in developing the province's natural gas resource. Remaining recoverable gas reserves increased by over 50% over the five year time period 1981 to 1985 to a level of 63 million cubic metres. These reserves are relatively small compared to Canadian reserves but are sufficient to meet Saskatchewan demand for at least 15 years as well as to supply some markets outside of Saskatchewan. Consumption in Saskatchewan has been relatively flat but the customer base has been actively expanded since 1983. By the end of this year over 20 thousand customers, predominantly in rural areas, will have been added under the Saskatchewan Natural Gas Distribution Program. Natural gas, widely used by industrial, commercial and residential customers meets 42% of total energy requirements in Saskatchewan compared to 30% in Canada.

APPENDIX B

Saskatchewan's Oil Supply

At present, Saskatchewan has a productive capacity of 35,000 cubic metres of crude oil per day or approximately 13% of Canada's total productive capacity. Our production of crude oil is currently 65% heavy oil (as defined by the National Energy Board to include what we call medium oil) and 35% light oil. These production mix figures have remained relatively constant over the last ten years and will not likely change significantly in the near future because of low oil prices.

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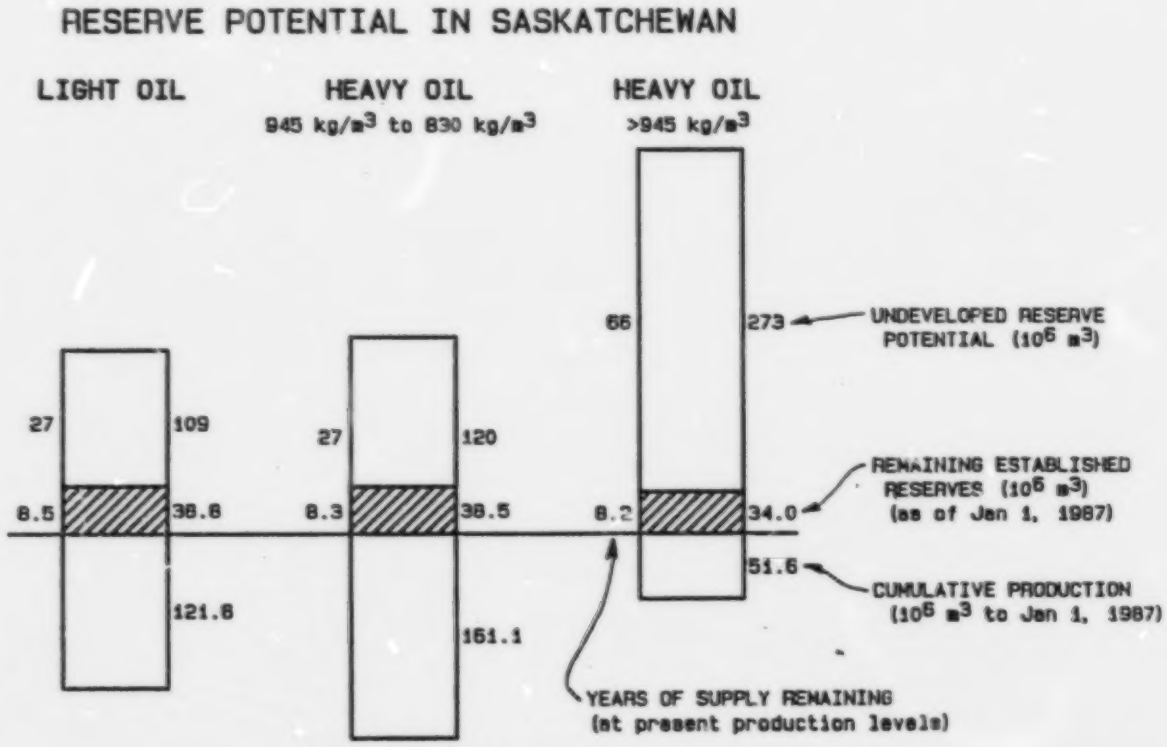
Reserve potential for each of the province's three main crude types is shown below.



The ultimate original oil-in-place in the heavy oil prone area of Lloydminster and Kindersley has been estimated by various sources to be 4 billion cubic metres (25 billion barrels). A recent report prepared by Saskatchewan Energy and Mines defined 2.8 billion cubic metres (17.6 billion barrels) of original oil-in-place with economic potential (greater than 1 metre of net pay), with an expected recovery of 168 million cubic metres (1050 million barrels) by primary production methods. The difference between the ultimate and the defined original oil-in-place is undiscovered potential.

This report further identified 622 million cubic metres (3919 million barrels) of this original oil-in-place as having a net pay of greater than 6 metres and therefore having potential for enhanced oil recovery. A 19% recovery factor for EOR, applied to this oil-in-place volume, represents 118 million cubic metres (740 million barrels) of additional production from these higher grade accumulations. A further 72 million cubic metres of primary production is expected from undiscovered potential.

The department estimates that for the Lloydminster and Kindersley areas the initial "established" heavy oil (> 945 kg/m^3) reserves as of January 1, 1987, are 85.6 million cubic metres (539 million barrels) of which 34.0 million cubic metres (214 million barrels) are yet to be recovered. Established reserves are only assigned to producing areas with a primary or waterflood recovery factor, as appropriate. These reserves also include recovery from enhanced oil recovery projects but limited to the area of the project.

The light and heavy crude oil potential in other areas of the province cannot be assessed in the same terms as Lloydminster/Kindersley heavy oil. The initial established Lloydminster/Kindersley heavy oil reserves represent, on average, only a small percentage of the defined original oil-in-place because recoveries under primary methods are very low. In general, recoveries under primary or waterflood methods for other crude types are significantly more than for Lloydminster/Kindersley heavy oil. However, significant potential exists in the application of enhanced oil recovery (EOR) projects to increase recovery in both light and heavy gravity reservoirs.

According to department estimates, the initial oil-in-place for heavy crude oil (945 to 830 kg/m^3) in the Swift Current and Weyburn/Estevan areas is 922 million cubic metres compared to initial recoverable reserves of 199.1 million cubic metres, or 21.6% recovery on average. The department estimates that the remaining undeveloped potential for these areas is about 120 million cubic metres of recoverable oil. Of this amount 55% is assumed to be recovered through existing EOR techniques and 45% from new discoveries and reserve appreciations. Roughly 30% of the total remaining oil potential is predicted to be developed during the next ten years.

The initial oil-in-place for light crude oil in the Kindersley and Estevan/Weyburn areas is 739 million cubic metres compared to initial recoverable reserves of 160.4 million cubic metres, or 21.7% recovery on average. The remaining undeveloped potential for these areas is about 110 million cubic metres of recoverable oil. Of this amount 54% is estimated to be recovered through EOR and 46% from new discoveries and reserve additions. Over the next ten years about 28% of the total remaining oil potential is assumed to be developed. New and enhanced waterfloods and infill drilling should continue to result in new reserves being added in light oil areas. Also, new reserves will continue to be found through exploratory drilling.

APPENDIX C

Alternative Fuels

While the largest constraint to the widespread use of alternative transportation fuels currently is competitively priced petroleum-derived fuels, there do already exist niche markets where alternative transportation fuels are established competitive fuels. For example, compressed natural gas is established as a competitive fuel in high mileage urban fleets and methanol/ethanol/gasoline blends are being sold successfully by independent gasoline distributors. However, further research and development into the technologies of producing alternative transportation fuels can substantially enhance the market penetration and competitiveness of alternative fuels.

The following market opportunities for production and utilization of alternative transportation fuels are of potential interest to Saskatchewan, and reflect our concern for fuel supply to the agricultural sector.

Ethanol:

Ethanol has the potential to contribute to transportation fuel demand as an octane enhancer and gasoline extender. The production of ethanol from Saskatchewan grain is of significant interest to Saskatchewan as it offers potential for expanded domestic markets for Saskatchewan farmers. While the use of ethanol/gasoline blends is well established in the marketplace further production research and development is required. Integrated systems with by-product utilization offer the opportunity to improve the efficiency and cost-competitiveness of ethanol.

Compressed Natural Gas:

Technical constraints are the biggest hurdle to the increased market penetration of compressed natural gas as a transportation fuel. With extension of the gas distribution system to farms in Saskatchewan, significant potential exists for the use of compressed natural gas in farm vehicles and equipment. However, additional technical development of small scale compressed natural gas distribution systems is required before widespread application in the agricultural sector can be achieved.

Diesel Substitutes:

The production of diesel substitutes from oil seeds such as canola hold potential to expand the domestic markets for Saskatchewan grown oil seeds and would enable farmers to produce their own fuels. Extensive research, however, into the refining of diesel substitutes from oil seeds and their performance characteristics in compression ignition engines would be required before any commercialization of these fuels.